

THE ARCHIVING OF METEOR RESEARCH INFORMATION
NECHITAILENKO V.A.

Soviet Geophysical Committee
Moscow, USSR

As was noted in the GLOBMET Planning Document, the project has as its main aim intensification of research in the fields of meteor astronomy and meteor geophysics on the basis of recent achievements in these fields and expansion of international cooperation into meteor research.

The GLOBMET Project has become one of the most popular projects out of which fruitful international cooperation in meteor research is successfully developing. Our Symposium and participation in it of representatives of many meteor research centers give convincing evidence of this.

The author's intention is not to review the results obtained over the past years under GLOBMET but to discuss some of the problems the solution of which will guide further development of meteor investigation and international cooperation in this field for the near term. Of course, the main attention will be paid to problems which the meteor community itself can solve, or at least expedite a solution. Most of them are more or less connected with the problem of "information archiving"!

"Information archiving" deals with methods and techniques of solving two closely connected groups of problems. The first one concerns the analysis of data and information as an integral part of meteor research and dealing with the solution of certain methodological problems. The second deals with gathering data and information for the designing of models of the atmosphere/meteor complex and its utilization.

Essentially GLOBMET is a methodologically-oriented project. Following Fig. 1 which shows in a simplified form main components of scientific investigation and connections between them it can be said that to achieve its goals (theories and models) the project focuses attention on experiment, data gathering and analysis as the initial points.

There are at least two areas where joint efforts can produce the maximal possible effect. The first is expansion of meteor observation networks, installation of new observatories, modification of old ones, unification of soft- and hardware parameters and fitting them into an agreed unified series.

The second line along which international cooperation under GLOBMET should develop (and probably the more promising one) is connected with the creation of data bases and archives, as well as improvement of international data exchange and the "suppliers/users" interaction.

a) Gathering, processing and managing of data.

The concept of gathering, managing and exchange of data, as it was defined when the WDC system was created, has mainly a discipline-oriented character. Such approach does not secure solution of many tasks, in the first place that of compatibility of data belonging to different scientific disciplines. The modern approach to the interpretation of atmospheric and

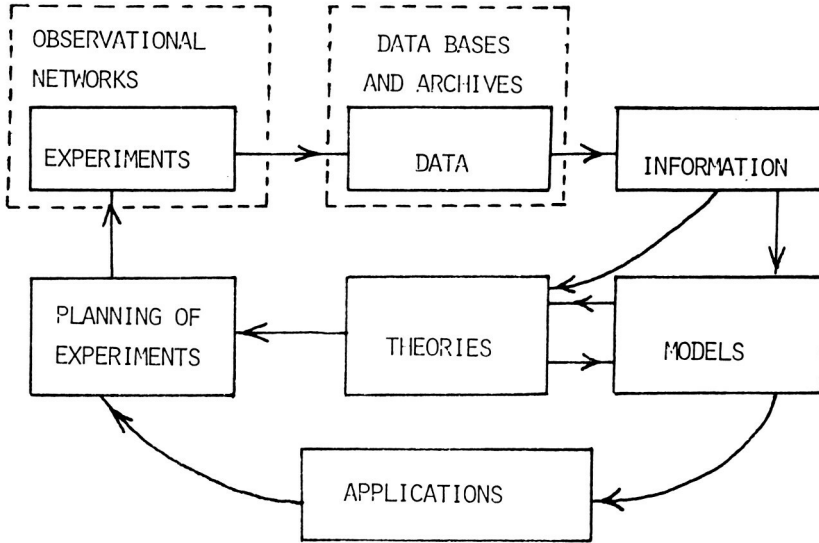


Fig. 1 Scientific investigation components and connections among them.

meteoric phenomena involves data obtained using a wide spectrum of measuring devices and installations. The problem of data compatibility seems to be one of the most important issues here.

Designing an effective data managing system presupposes solving, among others, the following problems:

- development of coordinated conceptional data models and their unification;
- designing of Integrated Data Processing System as an aggregate of data bases and software for checking, editing and processing of data interacting through a certain standard interface;
- ensuring of compatibility, homogeneity and representativity of data.

The Draft Manual on Meteor Radar Observations recommends as a first step a no more than 2- or 3-level structure of data so that future recommendations would not conflict with present protocols and software.

b) Data classification.

At present there is no unified meteor data classification (or Planetary Geophysics data, for that matter). Most common are a hierarchial approach to data exchange accepted by the WDC-A and WDC-B (1981) and the data classification used by the MAP Data Management Committee (1982).

The first approach deals with classification of data levels according to the type of data center. The second deals with the data representation level, i.e., data structure and formats.

The second approach corresponds to the classification proposed in the Fifth Edition of the ICSU Guide to International Data Exchange through the WDCs. This classification is based on processing, organization and analysis of data.

Level-0: Physical samples from which useful information is derived;

Level-I: Analog or digital observational/instrumental data in engineering units, e.g. radiosonde, telemetry, ionograms, etc;

Level-II: Scaled and calibrated observational data (Level-0 or Level-I) transformed into scientific units and variable parameters derived from a mix of observational data, e.g. cloud tracked winds, meteor radar winds, temperature profiles, etc.

Level-III: Analyzed fields, model output products, and special computational or processed results tailored to users requirements, e.g. hemispheric/global analyzed grid-point fields of wind direction/speed, etc.

c) Data accessibility.

When one works with data in the Center using some sort of soft- and hardware to implement searches by important classification parameters

(keyword), the level of technical accessibility of data becomes quite important.

Levels of accessibility of various kinds are compared in the Table with those defined by the MAP Data Committee as the Technical Status of data and are as follow:

First level (I-level) - data in machine-readable form presented in agreed formats of international data exchange (WDC's formats)

Second level (R-level) - data in machine-readable form presented in regional or/and individual formats (formats of regional data centers)

Third level (A-level) - analog data and hard copies.

Table I.

Data media	I	I	
Technical status of data according to MAP classification	I	I	
	I	I	
	I	Machine-readable	
	I	(cards, tapes, discs, etc.)	Others
	I		
	I		
Local individual formats	I		
	I		
	I	R-level	
Formats of regional centers	I		
	I		
	I		
	I		A-level
International formats	I		
	I	I-level	
	I		

The technical accessibility of data is only one of the parameters of logical and physical accessibility of data to users, but problems that need to be solved go far beyond those only of logical and physical accessibility.

Everyone knows that the development of research techniques, the use of more and more up-to-date means of measurement and observation, especially when carrying out comprehensive information-saturated experiments, lead to a situation when one needs more frequent access to data but utilization is found to be restricted by authors and owners of data. This restriction is intended to prevent uncontrolled copying, dissemination and use of data. The traditional WDC concept of free data exchange and dissemination does not guarantee author's sole rights to data and results of data analysis.

Further development of "suppliers/users" data exchange on an international scale should have the highest priority to accompany the existing WDC system (or as its integral part) with a special service providing the exchange of "non-free" data. Most such data are obtained during special observational campaigns or using unique devices. For convince sake, we shall use the term "project data" for any sort of data that are not free.

Each unit of such data included in the Data Archives is proposed to be accompanied with a special parameter, namely, the Copyright Level (CL). Values of the Copyright Level are defined below:

CL=1 free data (data for free dissemination),
 CL=2 data, distribution among project/campaign participants,
 CL=3 data which can be copied only by permission of the author/owner.

The CL=3 data should probably be stored at institutions where they are produced but Data Centers should also have a special service providing at least the description of the data in their directories and having them ready for eventual use in their archives and bases. Copying and distribution of these data is to be exercised only on the author's (owner's) request.

The authorship of each data level is to be ensured by:

- including the author's name in the description of the corresponding data sets;
- registering all the requests for data which have been filled;
- meeting requests for the CL=3 data only upon the author's consent. The author's (or Principal Investigator's) consent is also needed when a request on the CL=2 comes from persons (institutions) not included in the project/campaign participants list.

The CL=2 data are to be converted into the CL=1 data after a fixed time interval defined by the Principal Investigator (or Working Group in charge) of the project/campaign under which these data were obtained.

The CL=3 data are to be converted into CL=2 data by the author/owner of the data, but hopefully within a reasonable time frame.

d) Systems for information backing of meteor research

Soviet researchers of meteor phenomena attach great importance to solution of the problems mentioned above. Two of the eight initiatives of the National Program of the USSR participation in the GLOBMET (1984) (further on designated as GI-5 and GI-6) concern these problems.

The main aim of the GI-5 is to analyze typical tasks of meteor studies and processing algorithms and to develop a software system for meteor research (SMR).

The principal components of such system are shown in Fig. 2. Of primary importance here is an Integrated Meteor Data Processing System (IMPDS) which would form a component subsystem of the SMR.

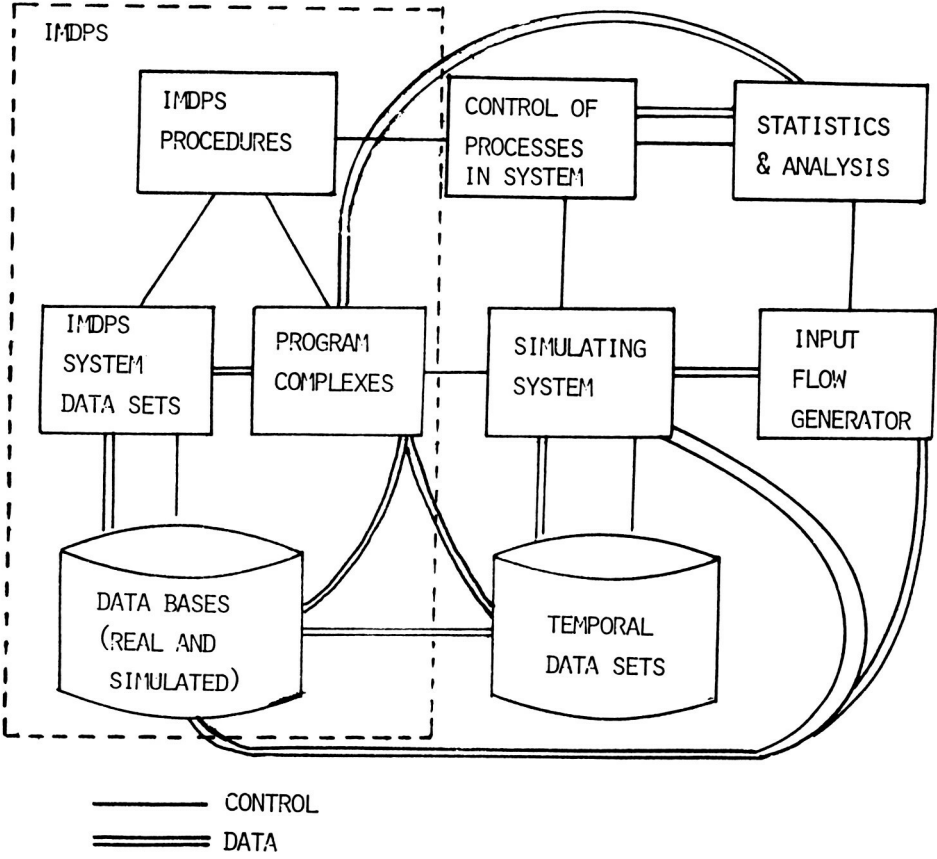


Fig. 2 Integrated meteor data processing system.

The IMPDS must become a basis for solving both the task of constructing the SMR as a whole and methodological tasks of GLOBMET as defined in Part III of the GLOBMET Planning Document.

Following the existing trends in the development of computer systems and networks, as well as data acquisition systems, the software components are being worked out under the GI-5 in order to be integrated into the local and distributed database management system.

The GI-6 is aimed at analysis of data and methods of observation with a view to developing indices adequately characterizing methods and results of observations and solving the problems of data and method comparability. An index here denotes a certain statistical generalization designed from space-and-time parameters of meteor observations and reflecting the most essential characteristics of a given group (complex) of observation.

e) Automated information-inquiry system

The experience gained in the course of joints efforts under the GI-5 has been used in the draft project of the Automated Information-Inquiry System (AIIS) that is now being developed at the Soviet Geophysical Committee. Fig. 3 shows the main parts of the AIIS and connections among them.

The AIIS architecture is optimized in such a way as to provide an effective preparation, in interactions mode, of inventories and directories on users' requests and standard processing of machine-readable data. The AIIS must include software means for the following tasks:

- work in interactive mode on the General Data Inventory, preparation of data inventories on request;
- work on the General Data Directory, preparation of data directories on request;
- standard procedures of processing, checking and editing of machine-readable data;
- users' procedures for processing Level-1 and Level-2 data;
- procedures for planning optimal experiments;
- procedures of situational simulation;
- users' applied procedures. These include interface modules through which users' programs can call the system data sets without any changes of the latter. All calls are registered;
- subsystem of international book exchange;
- subsystem of preparing formalized tasks by users and registering requests for copying data of all the three levels.

Prospects of information archiving of meteor research are obviously linked with creation of complex, all-embracing information backing system for Planetary Geophysics research under the GLOBAL CHANGE Project. It is

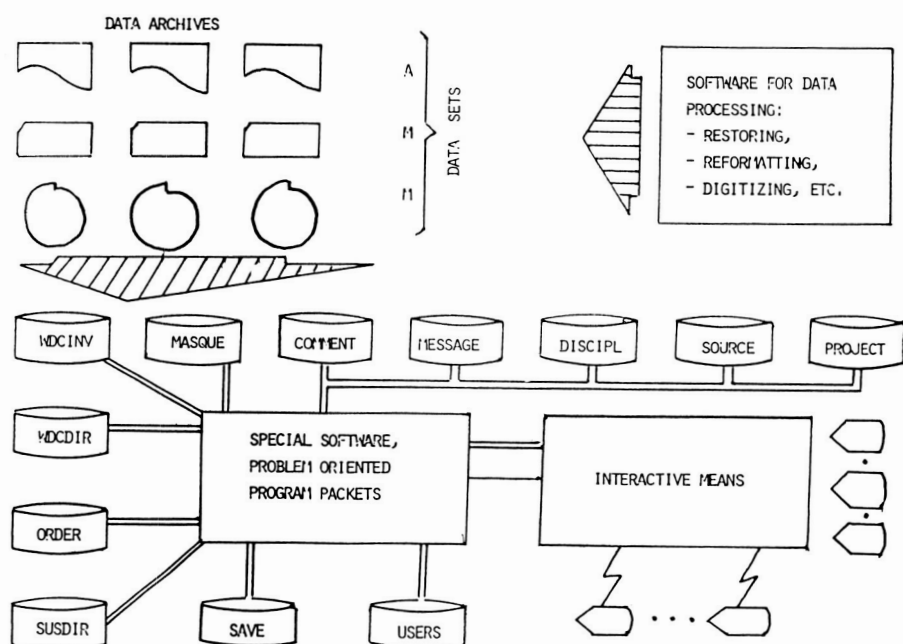


Fig.3 Proposed automated information-inquiry system.

WDCINV - data inventory, WDCDIR - data directory, MASQUE - set of data formats, COMMENT - commentary data set, MESSAGE - diagnostics, DISCIPL, PROJECT - descriptions of scientific disciplines and projects, ORDER - descriptors set, SUSDIR - data suppliers/user directory, SAVE - protocols, USERS - AIIS's user list.

proper to mention that the ICSU colloquium on IGBP stressed the importance of using new methods, especially for data processing and analysis, on an international basis, of large-scale data bases, meaning the creation, as the first step, of a rather complicated distributed information-inquiry system.

At this stage, it is impossible to give a complete picture of what is to be done. However, there is one thing worth considering right now.

Even though future research and observation program, initially under the GLOBAL CHANGE Project, mean extension of networks and application of mainly new methods and means of observation and analysis, the bulk of data to be analyzed will include either already existing data deposited in various centers and institutions or that obtained using existing observational means.

In such a case, the task of interpreting data appears to be by far more difficult than that of its collecting, despite the difficulties of the latter, which lie not only in the enormous amount of work to be involved in converting data into a machine-readable form and third-level representation status, but also in the lack of a necessary means of achieving data accessibility.

The development of a means of providing easy access to such a wide variety of geospheric and biospheric data present an extremely complicated task.

And yet, at least one part of it can be and must be solved as soon as possible by specialists of the corresponding disciplines. I have in mind the formulation of conceptional models, data structures and formats, a provisional but representative data index system, and standard processing algorithms, especially algorithms for converting Level -1 and Level-2 data into that of Level-3.

The task is very difficult. But we are hopeful it can be solved. The experience steadily gained by the meteor community allows one to be optimistic about the immediate solution of at least the "data-indices-algorithms" problem of meteor geophysics and astronomy.

References

1. GLOBMET Planning Document, 1982, MAP Handbook, Vol. 7, pp. 20-33.
2. Joint Report of WDC-A and WDC-B2, 12981, Moscow, December.
3. MAP Data Management Committee, Questionnaire No. 1982.
4. Soviet National GLOBMET Program, 1984, in: Global Meteor Observation System, VINITI Publ. House, Moscow, pp. 5-26 (in Russian).